Using CLO3D to Facilitate Design Collaboration

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Background and Purpose

The collaborative process of costume design requires many forms of visual communication, including costume research, drawings and fabric samples. Traditionally carried out on paper, recent research suggests that 3D apparel simulation software offers opportunities to enhance this process (Porterfield & Lamar, 2017, 2021), however, those insights are based on hypothetical scenarios. This study examined the potential for using 3D apparel simulation software as a tool in the costume design process in a real-time production setting for a dance performance. The researchers were particularly interested in the potential to facilitate conversations about range of motion and costume movement using 3D software, as demonstrated in a recent study focusing on musicians (Villanueva & Min, 2024).

The research was led by a costume designer and a choreographer, who provided reflective evaluations throughout the process as researcher/subjects. The dancers also provided feedback on the use of 3D simulations in design communication. The objectives of the research were to record the process of implementing 3D apparel design software (CLO3D), and to examine the effectiveness of this tool through the lens of the participants (designer, choreographer, and dancers).

Methodology

Project Activities and Timeline

This project was built around a production timeline starting in October 2023 and ending in late March 2024. After an initial feasibility discussion, the choreographer and designer agreed to experiment with using 3D apparel visualization software as a primary visual communication tool to design costumes for one piece involving 13 dancers. A rough timeline was established, with the goal of having approved designs in December, a design focus-group meeting with dancers in January, and costumes completed by dress rehearsal on March 18.

Data Collection and Participants

As it focuses on an emerging area of inquiry, qualitative methods were well suited to this project (Merriam & Tisdell, 2016). Reflective self-study is a common tool used in design research to help investigators ground their process through rigorous benchmarking and process evaluation (Vaughn, 2017). Primary investigators provided design meeting notes, and reflections on the collaborative process, as well as secondary data in the form of images, 3D simulations, drawings, and fabric samples. Dancers were engaged in the research process through a focus-group style design presentation in which they were invited to give feedback on the garment designs as well as on the experience of viewing them in the form of 3D simulations. Dancers also filled out post-production questionnaires to reflect on how their experience of the actual costumes matched their expectations based on the 3D simulations.

Data are divided into two primary categories reflecting either technical aspects of 3D software implementation or experiential aspects of the overall experience. Coding and analysis

were informed by previous research that identified points in the design/production timeline where 3D apparel visualization might be useful, such as initial design meetings and feedback sessions with performers (Porterfield & Lamar, 2021). Responses related to those opportunities were noted at each stage of the process. In addition, responses and reflections related to the constraints of the production calendar were identified. This paper focuses on outcomes related to participant experiences with the process, highlighting areas of success and suggestions for improvement as discussed below.

Results

Positive Outcomes to Designer Process Disruption

The costume designer/researcher in this project agreed to use CLO3D to communicate design ideas rather than the traditional approach of costume rendering. She reported discomfort with this approach, noting that CLO3D renderings seemed impersonal compared to traditional costume renderings, and that the time required to virtually cut and sew garments in the software might limit her process, stating, "*I usually show a choreographer a number of drawings to illustrate a range of possible silhouettes. I don't know if I will have time to make a lot of silhouette options in CLO."* These hesitations were swept away by the response of the choreographer to the initial design meeting. The designer shared surface design concepts in the form of watercolor drawings, and used CLO3D to map these onto garments, demonstrating the effects of an engineered printing approach. The choreographer's response was very positive, both to the designs and to the mode of showing them in the 3D software. She reported appreciating the ability to view the costumes from all angles, and the ease of visualizing multiple surface designs quickly and easily.

Productive Dancer Feedback Session

During the design meeting/focus group session with dancers, the designer shared 3D renderings of the costumes (figure 1), featuring surface designs individualized for each dancer per the choreographer's vision. These visual tools facilitated a productive discussion about ease of movement and wearability of the costumes. Dancers asked about fabric texture and movement potential, specifically referencing stretch and drape. One dancer, whose role in the piece required him to roll and move from a prone position on the floor, wanted to know if the fabric would move with him or if it would stick to the floor.

It is notable that most of the questions asked during this session point to the fact that the 3D software simply did not tell the dancers what they wanted to know about the fabric. Although the costumed avatars were shown in motion, the dancers did not feel they could make a judgement about the virtual fabric based on the simulation. In spite of this, however, the questions were productive and pointed to specific concerns the dancers had about their costumes. The designer was able to address these concerns through choice of fabrics and finishing details in the actual costumes.

Dancers also shared positive feedback on the costume surface design effects shown in the 3D renderings. They later reported that the actual costumes reflected their expectations in this area based on the 3D renderings.

Discussion and Future Work

This study reinforced the findings of earlier researchers that 3D apparel simulation software could facilitate productive discussions with choreographers and performers (Porterfield & Lamar, 2021; Villanueva & Min, 2024). In spite of the fact that the 3D simulations did not

provide comprehensive information about fabric, the simulations prompted helpful questions and feedback and provided a clear view of silhouette and surface design intention. Future work by this research team will focus on building this body of qualitative data, as well as on recording best practices for software implementation in the costume design and production process to further elucidate factors that might impact the adoption of 3D simulation for the purpose of costume design related to the production timeline and the user experience.

References

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Figure 1
3D Costume Rendering